CLAIMS

What is claimed is:

1   1.   A group communication protocol system comprising:

2   a plurality of nodes on a first local area network (LAN), the plurality of nodes

3   logically divided into at least a first group and a second group;

4   a first token to circulate among members of the first group to cause

5   communications among the members of the first group to be serialized;

6   and

7   a second token to circulate among members of the second group to cause

8   communications among the members of the second group to be serialized

9   independent of the first group.

1   2.   The system of claim 1, wherein at least one member of the first group is also a

2   member of the second group.

1   3.   The system of claim 1, wherein ownership of the first token is needed before a

2   node can send a message to the first group.

1   4.   The system of claim 1, wherein the communication among the members of the

2   first group comprises multicast messages.

1   5.   The system of claim 1, wherein the communication among the members of the

2   second group comprises broadcast messages.

1   6.   The system of claim 1, wherein the first and second tokens include a sequencing

2   mechanism.

1 7. The system of claim 1 further comprising one or more nodes on a second LAN,

2   wherein the one or more nodes on the second LAN are members of the first group.

1 8. The system of claim 1, wherein the first and second groups comprise replication

2   groups, each including at least one primary and at least one replica.

1 9. A group communication protocol system comprising:

2   a plurality of nodes logically divided into at least a first group and a second group;

3   a first token to circulate among members of the first group to cause

4   communications among the members of the first group to be serialized;

5   and

6   a second token to circulate among members of the second group to cause

7   communications among the members of the second group to be serialized

8   independent of the first group.

1 10. The method of claim 9, wherein ownership of the first token is needed before a

2   node can send a message to the first group.

1 11. The system of claim 9, wherein the communication among the members of the

2   first group comprises unicast messages.

1 12. A method comprising:

2   independently serializing message communication among members of a first

3   group and members of a second group on a local area network (LAN) by

4   circulating a first token among members of the first group; and

5   circulating a second token among members of the second group.

1 13. The method of claim 12, wherein the members of the first group include a primary

2   entity and at least one replica for the primary entity.

1 14. The method of claim 12, wherein the members of the second group include a

2   primary entity and at least one replica for the primary entity.

1 15. The method of claim 12, wherein the first token includes a sequence number.

1 16. The method of claim 15, further comprising:

2   a. receiving the first token at a first member of the first group;

3   b. incrementing the sequence number

4   c. sending a broadcast message to the first group using the sequence number;

5   d. repeating b-c for each message, if any, at the head of one or more message

6   queues of the first member that are destined for the first group or until a

7   specified event has occurred; and

8   e. passing the first token to the next member of the first group.

1 17. A method comprising:

2   receiving, at a first member of a first group on a local area network (LAN), a first

3   token associated with the first group from another member of the first

4   group on the LAN;

5   incrementing a sequence number associated with the first token;

6   sending a message to the members of the first group using the sequence number

7   associated with the first token;

8   passing the first token to a next member of the first group on the LAN;

9   receiving, at a member of a second group on the LAN, a second token associated

10   with the second group from another member of the second group on the

11   LAN;

12   incrementing a sequence number associated with the second token;

13   sending a message to the members of the second group using the sequence

14   number associated with the second token; and

15   passing the second token to a next member of the second group on the LAN.

1   18.   The method of claim 17 further comprising:

2   replacing an all received up-to (aru) field associated with the first token with a

3   lower aru associated with the first member of the first group.

1   19.   The method of claim 17, wherein the sending a message to the members of the

2   first group comprises sending a multicast message.

1   20.   A replication group system comprising:

2   a first replication group located on a local area network (LAN), the first

3   replication group including a first primary entity and a first group of one or

4   more replica entities wherein members of the first replication group are

5   members of a first group;

6   a second replication group located on the LAN, the second replication group

7   including a second primary entity and a second group of one or more

8   replica entities wherein members of the second replication group are

9   members of a second group;

10   an intersection between the first replication group and the second replication

11   group including at least one replica entity that is a member of both the first

12   group and the second group;

13   a first token circulating among members of the first group causing

14   communications among the members of the first replication group to be

15   ordered; and

16   a second token circulating among members of the second group causing

17   communications among the members of the second replication group to be

18   ordered independent of the first replication group.

1 21. The system of claim 20 further comprising:

2   a first storage area associated with the intersection, comprising serialized

3   messages for the first replication group; and

4   a second storage area associated with the intersection, comprising serialized

5   messages for the second replication group.

1 22. The system of claim 20, wherein at least one replica entity in the intersection

2   operates as a warm or cold replica for the first primary entity and a warm or cold

3   replica for the second primary entity.

1 23. The system of claim 20, wherein at least one replica entity in the intersection

2   operates as a hot replica for the first primary entity and a warm or cold replica for

3   the second primary entity.

1   24.   A method comprising:

2   receiving at a first primary entity of a first replication group on a first local area

3   network (LAN) a first token associated with the first replication group, the

4   first token logically imposing a first token ring upon the first replication

5   group, the first replication group including the first primary entity and a

6   first group of one or more replica entities;

7   receiving at the first primary entity a second token associated with a second

8   replication group on the first LAN, the second token logically imposing a

9   second token ring upon the second replication group, the second

10   replication group including a second primary entity and a second group of

11   one or more replica entities;

12   incrementing a sequence number associated with the first token;

13   incrementing a sequence number associated with the second token;

14   sending a message from the first primary entity to the first replication group using

15   the sequence number associated with the first token; and

16   sending a message from the first primary entity to the second replication group

17   using the sequence number associated with the second token.

1   25.   The method of claim 24, wherein the first replication group further comprises a

2   replica entity located on a second LAN.

1   26.   The method of claim 24, wherein the first and second tokens comprise Totem

2   tokens.

1   27.   A method comprising:

2   a step for receiving at a node on a local area network (LAN) a first token

3   associated with a first group on the LAN;

4   a step for sending a first message to the members of the first group using a

5   sequence number associated with the first token;

6   a step for passing the first token on to a next member of the first group;

7   a step for receiving at a second node on the LAN a second token associated with a

8   second group on the LAN;

9   a step for sending a message to the members of the second group using a sequence

10   number associated with the second token; and

11   a step for passing the second token on to a next member of the second group.

1   28.   The method of claim 27 further comprising:

2   a step for incrementing the sequence number associated with the first token; and

3   a step for incrementing the sequence number associated with the second token.

1   29.   The method of claim 27, wherein the first and second tokens comprise Totem

2   tokens.

1   30.   A machine-readable medium having stored thereon data representing sequences of

2   instructions that when executed cause a machine to:

3   receive a first token associated with a first group on a local area network (LAN);

4   send a message to the members of the first group using a sequence number

5   associated with the first token;

6   receive a second token associated with a second group on the LAN; and

7   send a message to the members of the second group using a sequence number

8   associated with the second token.

1   31.   The machine-readable medium of claim 30 further including instructions to:

2   increment the sequence number associated with the first token; and

3   pass the first token to a next member of the first group.

1   32.   The machine-readable medium of claim 30 wherein the first and second tokens

2   comprise Totem tokens.

1   33.   A group communication system comprising:

2   a plurality of nodes on a local area network (LAN) logically divided into a first

3   group and a second group;

4   a first token means, circulating among members of the first group, for serializing

5   multicast communications among the members of the first group; and

6   a second token means, circulating among members of a second group, for

7   serializing multicast communications among the members of the second

8   group independent of the first group.

1   34.   The system of claim 33 wherein the first and second token means include a

2   sequence number.

1   35.   The system of claim 34, wherein ownership of the first token means is needed

2   before a node can send a message to the first group.

1   36.   A method comprising:

2   imposing a first logical token ring on a local area network (LAN) and serializing

3   communications among a first subset of nodes on the LAN by causing a

4   first token to be circulated among the first subset of nodes; and

5   imposing a second logical token ring on the LAN and serializing communications

6   among a second subset of nodes on the LAN by causing a second token to

7   be circulated among the second subset of nodes.

1   37.   The method of claim 36, wherein the first and second tokens comprise Totem

2   tokens.

1   38.   The method of claim 36, wherein ownership of the first token is needed before a

2   node can send a message to the first subset of nodes.